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Soviet and East European Computer Networking: Prospects for Global Connectivity

A Research Paper

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Soviet and East European Computer Networking: Prospects for Global Connectivity

A Research Paper

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September 1990

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Soviet and East European Computer Networking: Prospects for Global Connectivity (

Summary

Information available as of 1 July 1990 was used in this report.

The entry in April 1990 of the USSR, Bulgaria, Czechoslovakia, Hungary, and Poland into the European Academic and Research Network (EARN) is likely to have a profound effect on scientific communities throughout the Soviet Union and Eastern Europe. Our analysis of open-source material, including EARN messages, suggests that the new EARN members will reap significant and immediate benefits by virtue of EARN's links to hundreds of research centers on the US BITNET academic network as well as centers on many other Western networks. A more fundamental change will be the steady erosion of traditional Soviet and East European barriers to interorganizational and international scientific collaboration as Eastern researchers use their new data-sharing links.

While the East's primary incentive to undertake computer networking is to increase the West-to-East flow of information, we believe this can only come about at the cost of substantially opening up its own scientific communities:

- Interorganizational impediments in the USSR and Eastern Europe will be readily bypassed by computers. In a network environment, access to information and to colleagues will become more egalitarian—researchers and scientists low in the organizational hierarchies will enjoy greatly enhanced communications freedom.

- The West will have the opportunity to gain a better appreciation of the personalities, organizations, and products of Eastern research. According [redacted] the best and brightest researchers and their organizations have been the most avid consumers of Western information—we can expect that networking will turn some of them into the most prolific talkers.

Soviet and East European domestic computer networks, now relatively isolated and underutilized according to Western visitors, could flourish with the advent of foreign connections. The Soviet Akademset' network, for example, will become considerably more valuable if it provides a reliable bridge to vast foreign networks. Similarly, the underdeveloped regional networks in Eastern Europe are likely to be improved and expanded as users press to take advantage of foreign research networking.

Some significant barriers will moderate connectivity progress—chief among these is the poor telecommunications infrastructure throughout the USSR and Eastern Europe. High-quality commercial connections between the West and Moscow, such as the San Francisco–Moscow Teleport joint venture, are forming, chiefly to support Western business in the USSR; an enormous investment of resources would be required to extend this level of service into the rest of the Soviet Union. But selective investment in regional, dedicated connections required for research networking could be one of the most effective ways to upgrade the state of Soviet scientific research—vital to future technological competitiveness—and this is likely to be a priority of the Soviet Government.

We believe that expanding network access will moderately increase the threat of covert exploitation of Western data sources that already exists from Soviet and East European intelligence services. The case of the "Hannover Hacker" shows that Soviet intelligence is capable of exploiting the Western networks through surrogates. Increased East-West exchange will afford Soviet and East European intelligence services with more efficient means for identifying intelligence targets.

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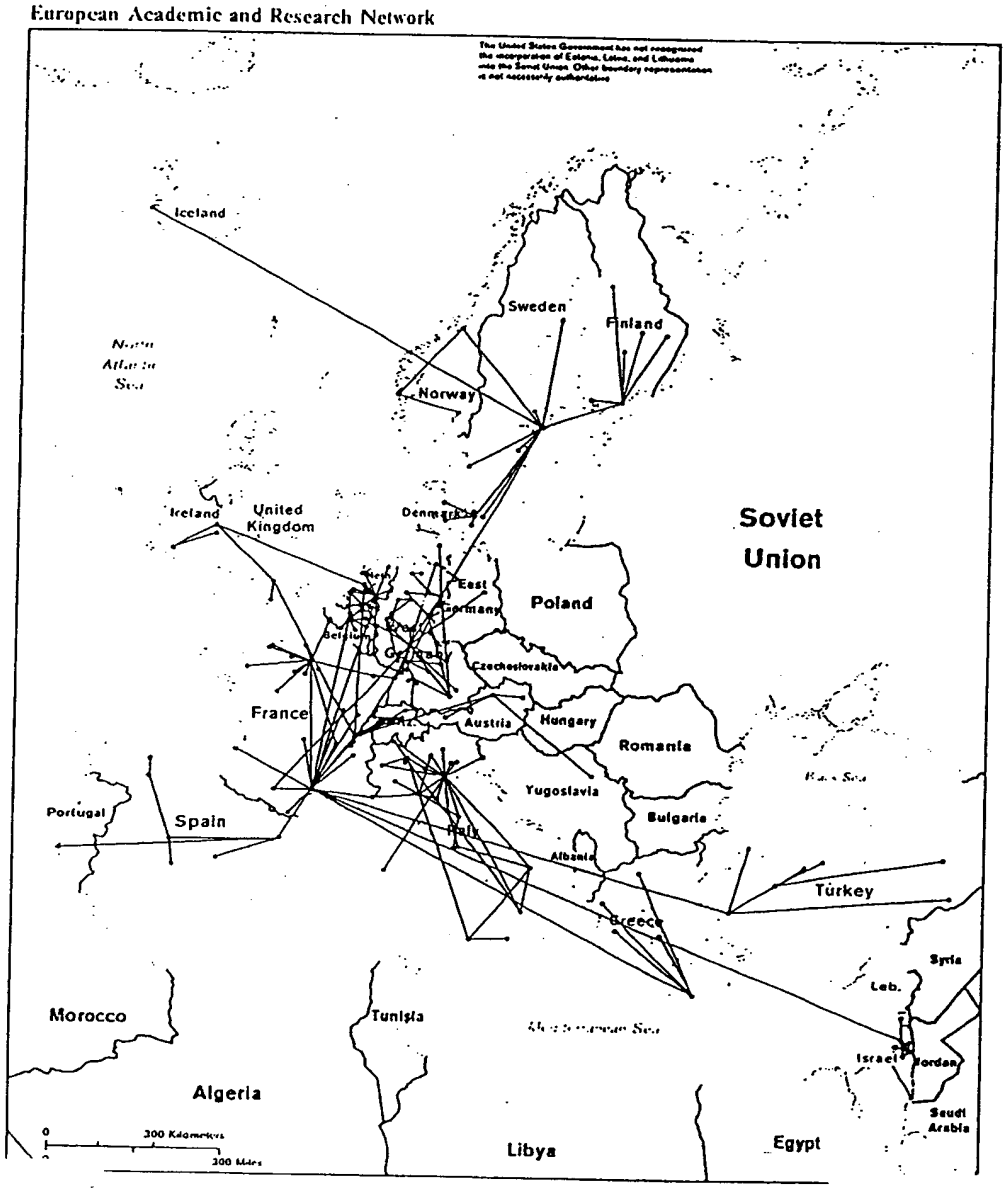
Figure 1
European Academic and Research Network



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Soviet and East European Computer Networking: Prospects for Global Connectivity

Elaborate Research Computer Networks in the West

Computer networking, including the interconnection of networks, has become a major resource in the West and in Japan. Networking allows for the optimal distribution of expensive computing resources; access to dispersed sources of data; and efficient, timely communications among user communities.[1] Collaborative research networks—with costs distributed among participating organizations and at no charge to individuals—have begun to knit together widely dispersed scientific and academic organizations. Internetworking—the interconnection of isolated networks into networks of networks—has progressed to the point where most research, academic, and commercial networks can routinely exchange electronic mail.

In the West, networks generally fall into one of three categories:

- Government-subsidized (the Internet).
- Collaborative academic (Western Europe's EARN—European Academic and Research Network) (see figure 1).
- Commercial (Compuserve).

Interconnections among the three types have become increasingly widespread (see inset) so that Western scientists now enjoy access to a rich and varied range of communications services.

Soviet and East European Research Networks

In contrast to the explosive growth of Western networks, those in the USSR and Eastern Europe are extremely rudimentary. Recent political changes, coupled with ongoing worldwide evolution of information technologies, have gun to increase the networking options available to CEMA users.[2] The rate at which CEMA networks grow will be determined by:

- Adaptability of existing CEMA national and regional networks.
- Availability of adequate telecommunications links.

During the past decade, CEMA imports of foreign computers have provided a solid base for using the services that global networking can provide. COCOM restrictions on the export of personal computer (PC) technologies to the CEMA countries, for example, have been almost completely removed. This is, in part, a reflection of the fact that such technologies have become global commodities and are widely available from a host of suppliers outside of COCOM control, such as Taiwan, South Korea, and Peru. We believe that the scarcity of hard currency for foreign purchases of general purpose computer technology is a far more significant barrier to CEMA imports than any current export control. Certainly, the controls now in force permit the sale of computers with performance in excess of the CEMA domestic production, even as much of that production has become the local assembly of imported components.

Hardware compatibility is not likely to be an issue in connecting Eastern and Western computer networks. The CEMA computer industries have very clearly sought Western standards. The CEMA-wide ES (Unified System) mainframe and SM (Small System) minicomputer programs are built on IBM and DEC (Digital Equipment Corporation) architectures, respectively. PC production adheres even more closely to global standards. The IBM PC architecture is endorsed throughout the CEMA countries as a direct result of the sheer size of the global IBM PC-compatible market.

[1] In this report, the term "computer network" refers to computers linked together to support such scientific research functions as electronic mail and file transfer. Many other forms of computer networking, for example, for military command and control or financial data transactions, are outside the scope of this study.

[2] CEMA, the Council for Mutual Economic Assistance, is the East European counterpart to the European Economic Community (EEC). With the increasing dissolution of the "Soviet Bloc," "CEMA" is used here as a convenient designation for the region under discussion (the USSR and the East European countries of Bulgaria, Czechoslovakia, Hungary, Poland, Romania, and, for the time being, East Germany).

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Primary Networks in the West

The best example of a government-subsidized research network is the Internet, which grew out of the US ARPANET project.[a] Starting in the late 1960s, computers at US Government, military, and commercial organizations conducting government-sponsored research were interconnected to permit the transfer of research data and maximize the utility of computers at the various sites of the network. ARPANET spawned similar networks, such as the US National Science Foundation–sponsored NSFNET (see figure 2) to provide remote access to its supercomputer centers, and these networks were themselves interconnected (internetworked)—the result was termed the Internet. The Internet carries only unclassified information, and it now extends to many foreign countries.

Collaborative academic networks, such as Western Europe's European Academic and Research Network (EARN), have developed in a manner similar to the networks of the Internet, but generally with less government involvement. EARN's 500-plus participants include academic institutions in Europe, the Middle East, Africa, South America, and East Asia. Scientists in Europe's collaborative research programs, such as Eureka and ESPRIT, use EARN for the timely exchange of research findings and optimize the use of expensive research facilities.[b]

EARN is connected to and fully compatible with BITNET, which, as of 1988, linked more than 400 colleges and universities in the United States.[c] Together the two actually constitute a single global research and academic network, expanding at a considerable rate. Each new organization added is required to provide for the cost (leased telephone connections, modems, and other equipment) of the new network link between it and an existing BITNET/EARN member. As a further condition of membership, a new member is expected to permit one or more new members to connect to it in the future. Users on EARN need not be aware of the network topology, as each network user is identifiable simply as a user/host name—for example, "SMITH@IRLEARN" is a user on one of several computers at the University College in Dublin—and routing is handled automatically by the network.

Commercial networks—such as Compuserve—generally consist of a set of user services, such as data bases, news feeds, and electronic mail. In most cases, these networks are accessible via the public telephone system; that is, to anyone with a personal computer or terminal. They charge periodic, per use, or hourly fees, which may include surcharges for such services as data base access. More recently, the commercial networks have begun to establish connections among themselves and with the noncommercial research networks. It is possible, for example, to send electronic mail from Compuserve through the Internet to an EARN user.

[a] ARPANET was originally sponsored by the Advanced Research Projects Agency (ARPA), now the Defense Advanced Research Projects Agency (DARPA).

[b] The European Strategic Program for Research in Information Technology (ESPRIT) and Eureka (a program for research in commercial technologies) fund and coordinate multicountry efforts.

[c] BITNET is described variously as an acronym for "Because It's There" NETwork and "Because It's Time" NETwork—in either case, the name reflects the fact that the technology required to construct the network was already readily available when the proposals for cooperation began to be promoted.

Although basic computing resources are pervasive in the CEMA community—at least within technical environments—telecommunications remain an intimidating barrier to computer networking. The deficiencies are most clearly visible in a comparison of the suitability of the public-switched telephone systems to support data communications, where the Eastern telephone network is generally incapable of supporting computer communication without error-correcting devices and specially conditioned (leased) lines. Several

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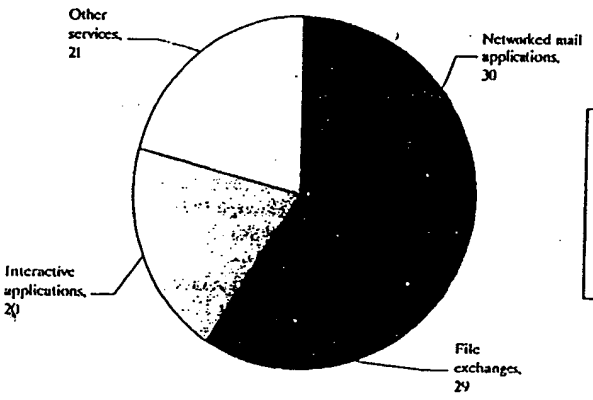
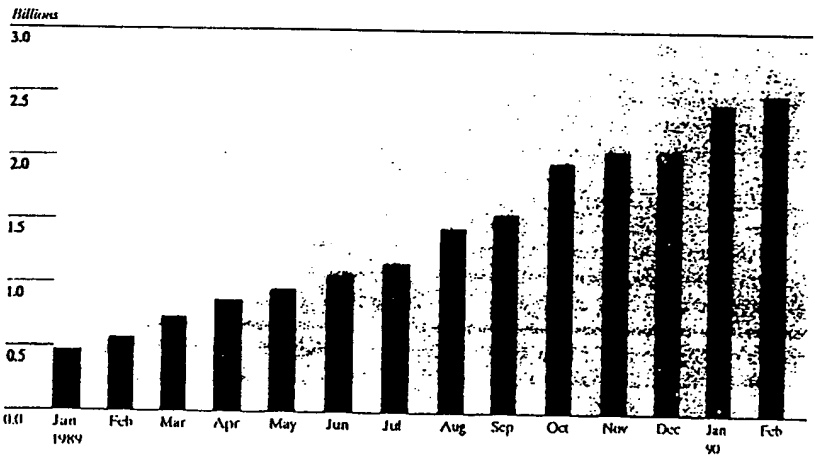
Figure 2
Growth and Uses of the National Science Foundation's NSFNET

NSFNET use by packets, February 1990
Percent



NSFNET transmits information in the form of "packets." When a file or mail message is transferred it is actually sent as a number of separate packets. An example of an interactive use would be remotely logging on to a supercomputer at a research center.

NSFNET monthly traffic in packets[a]



[a] Before 1989 monthly averages were on the order of 100 million packets.

joint ventures have been proposed or initiated that would involve Western investment in the CEMA telecommunications infrastructure, the most contentious being the proposed construction of a trans-Siberian fiber-optic link between Europe and Japan on which the USSR could piggyback some of its own domestic communications traffic.

Regional Networks: Capable But Isolated

Regional networks—within a city, district, or even as large an area as several Soviet republics—are the most easily formed, and several have been established around heavy concentrations of computer expertise. In the USSR this includes a substantial network in Moscow and networks formed around Academy of Sciences facilities in Riga, Leningrad, and Novosibirsk (see figure 3). A key feature of these networks is that the resources required to implement the network are more or less directed by a lead organization or group of organizations, for example, the Latvian Academy of Sciences, which poses fewer interorganizational difficulties.

The primary Moscow-area network is centered in the Institute of Automated Systems (IAS), which also serves as the lead organization for East-West networking. It includes at least three computers at the IAS, four computers at the All-Union Institute of Scientific and Technical Information (VINITI), two computers at the International Center for Scientific and Technical Information, and single computers at several other institutes. The IAS and several of the other institutes are also attached to the USSR Academy of Sciences' Akademset' network.

The Institute of Electronic Computing (IEVT) in Riga, headed by Eduard Yakubaitis, is a focus for networking for the Latvian Academy of Sciences. The Latvian Academy of Sciences is one of two Soviet partners in a proposed joint venture with a US communications firm to install a packet-switching data network in the USSR and has been heavily involved in computer-networking research for many years under Yakubaitis's direction.

There is also an extensive regional network in and around the Novosibirsk Akademgorodok (Academic City) of the Siberian Department of the Soviet Academy of Sciences. In addition to interconnecting the many computer-using institutes within Akademgorodok, the "Sibir" regional network is reported to serve remote institutes in Omsk, Tomsk, Krasnoyarsk, Irkutsk, and a few other remote sites.

National Networks: Minimal Resources

The USSR has a single national network—Akademset'—for its Academy of Sciences, and it is much less developed than its regional subcomponents (see figure 4). Akademset's resources are minimal. According to [redacted] funding for Akademset' is only 1.5 million rubles annually (which is well under $1 million). By way of comparison, the US Office of Technology Assessment's proposed budget for government investments in the US research networks amounts to $50 million yearly through 1991 and $100 million per year thereafter.

The hardware to support Akademset' is reported to have been developed at the IEVT in Riga and is based on dated domestic microelectronics. The network transmissions are slow in comparison with similar Western networks. In addition, the long-distance connections provided by the Ministry of Communications are often unreliable.

Other CEMA countries have comparable—albeit smaller—networks along the lines of Akademset'. The Hungarian Academy of Sciences has a network interconnecting computers at several institutes. Similarly, the Polish Academy of Sciences supports a network called KASK (National Academic Computer Network). None of these networks is particularly large. Moreover, they are likely to be rather insulated from other networks because of the poor communications infrastructure.

The CEMA countries participate in an intra-CEMA network analogous to Akademset'. This seems to be in the form of dedicated connections with the Moscow hub of Akademset' by institutes participating in the various national networks, for example, Hungary's academic network. Little information is available on the usage of these international links, but it is likely that they carry only a minimal level of data traffic.

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Figure 3
IASNET in Moscow

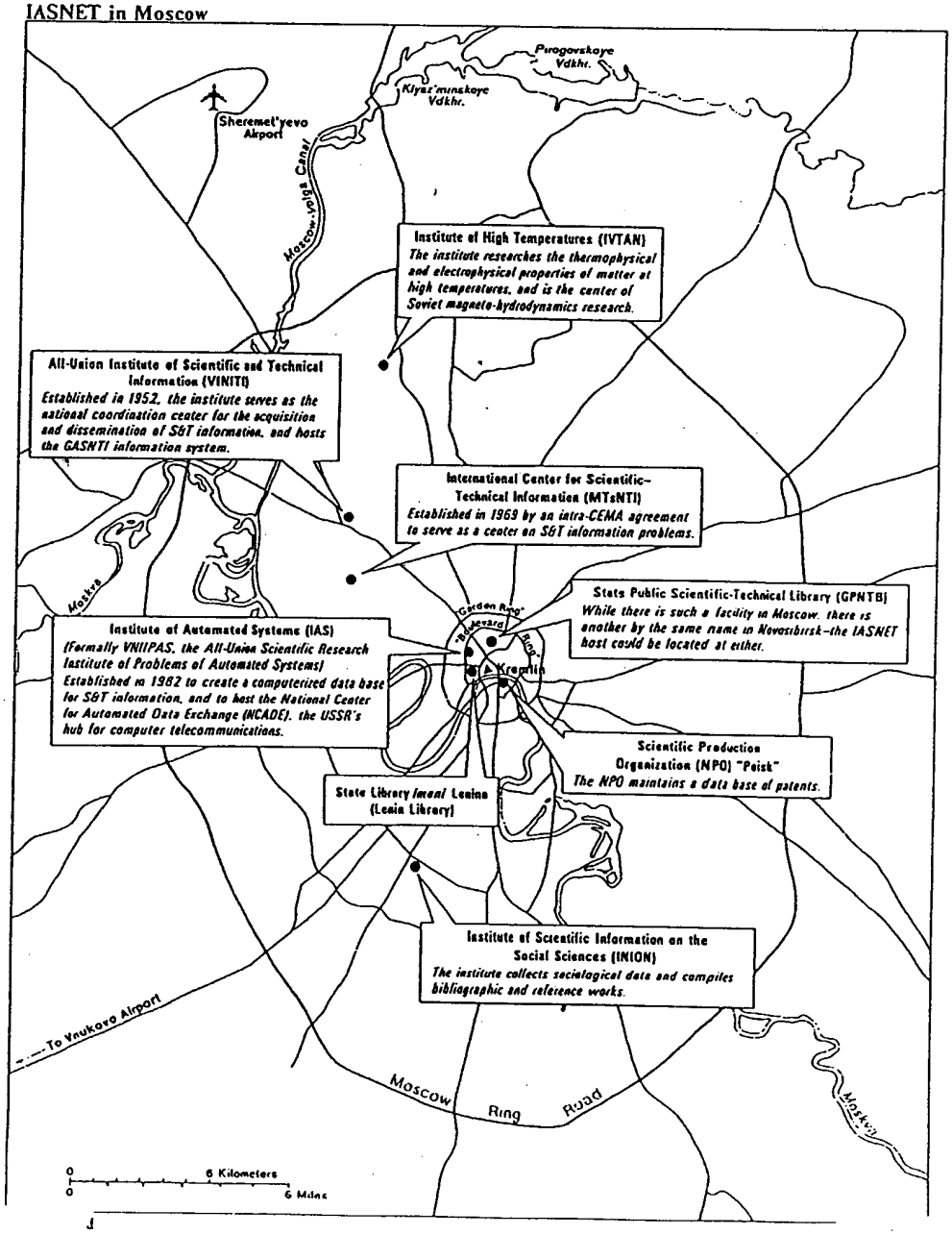

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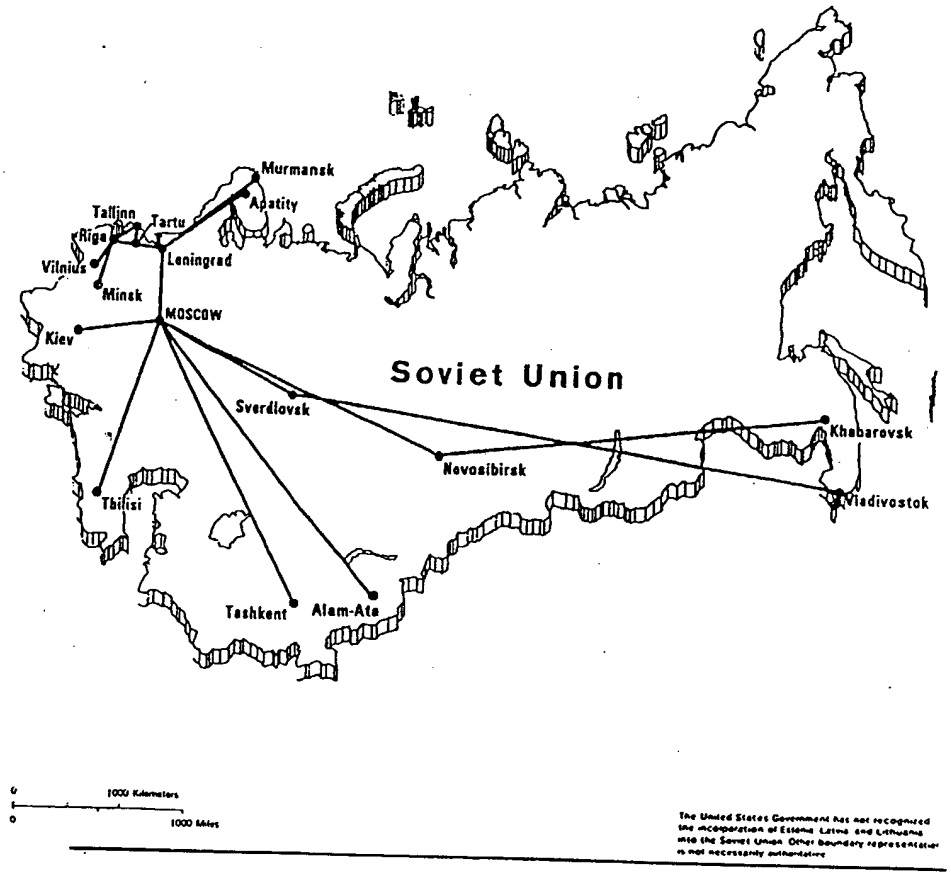
Figure 4
Soviet Akademset' Network



Networking Resources and Services—Rudimentary

Networking could permit more efficient use of scarce large-scale scientific processors such as the USSR's El'brus supercomputer family, but the current networks do not seem to promote such resource sharing. Our previous estimates of the capabilities of Eastern (that is, Soviet) large-scale scientific computers rate them as lagging the West by 10 to 15 years. Low levels of production and poor reliability further compound the problem of organizing sufficient computational power to support computer-intensive research.

Western networking efforts have, in many cases, been undertaken to optimize the use of expensive computation time on supercomputers, as with the US NSFNET. Acute infrastructural problems, coupled with poor interorganizational communication in general, render this difficult or impossible in the USSR. Below a given level of reliability, a computer is more a liability than a benefit as part of a network.

Various Soviet institutes maintain scientific and technical data bases, and the State Automated System of Scientific and Technical Information (GASNTI) is designed to be a national information service for these data. GASNTI seems to be a simple star network in which users establish a connection to a data base to query and retrieve data or documents. It does not seem to support the higher functions of a research network, such as electronic mail, that facilitate direct communication. Other East European countries have established data bases in a variety of areas, but there is very little evidence of data bases being available via any sort of network access.

East-West Connectivity

Special-Purpose Links

At its simplest, computer network communication is nothing more than the transmission of digital data over a communications medium. As such, it is a simple step to establish a computer-to-computer link using modems and a normal telephone connection. Given the global reach of telephone services, it is possible to establish such a link—and, from multiple links, extensive networks—virtually anywhere in the world.

Simple links include a connection between the Soviet Institute of Space Research (IKI) and the European Space Operations Center (ESOC) in Darmstadt, West Germany, and a similar one to the Centre National d'Etudes Spatiales (National Center for Space Studies) in Paris. These links are used for the most rudimentary transfer of data, and the ESOC link is physically separate from the ESOC's connections to the extensive Space Physics Analysis Network.

According to messages posted on the Western research networks, two institutes in Hungary and Czechoslovakia are connected to a global network called "uucp." This is an extremely inexpensive form of networking based on the Unix operating system—computers forming the network pass messages by telephone connections made with some established frequency, for example, once per night—and it can take some time for a message to pass to a distant recipient.

The most unusual East-West computer connection seen thus far is a PC-based bulletin board system (BBS) that was set up in Tallinn, Estonia, with the assistance of Finnish computer users. The BBS was widely publicized in electronic mail messages and newsletters distributed over Western networks, and users from the United States, Japan, the United Kingdom and elsewhere managed to connect to it via long-distance telephone calls. Such a system could be expected to expand transborder communication in the Baltic republics—strengthening local cultural and economic ties.

General Connections—The Primacy of USSR's IASNET

A single Soviet organization provides the gateway for all significant computer communications traffic in the nonmilitary sector—the National Center for Automated Data Exchange (NCADE). The NCADE is hosted by the All-Union Scientific-Research Institute of Applied Automated Systems, more commonly called IAS. Both the institute and the center were established in 1982 to serve as a nexus for Soviet computer communication. According to [redacted] the NCADE operates "as a telecommunications node for connecting the USSR information centers as well as telecommunications companies abroad." Even though IAS may have duties apart from those of NCADE, most references to the above functions ascribe them to IAS.

IAS connections to the West are reported in open literature as consisting of several leased lines to Austria and Finland. These links, which support the

same communications protocols as are used by the Western data networks, provide access to the Radio Austria and DATAPAK networks and via these networks to most, if not all, of the other Western commercial and common-carrier networks. All of the links, however, are relatively slow—the total amount of data that can be transmitted over the East-West connections is certainly less than that carried by any single high-speed link in the many research and commercial networks in the United States and Western Europe. IAS also has a relatively high-speed connection with the United States via an Intelsat satellite connection to support the operations of the San Francisco–Moscow Teleport (SFMT).

IAS is without question the USSR's primary conduit for East-West data exchange, if not its monopoly supplier of international data communications services. The Moscow regional network may also be known as IASNET, as a result of IAS's prominence in its role as the East-West bridge. Through IAS the Moscow network provides the following services:

- Limited access by Soviet users to Western commercial networks, including users at remote sites of Akademset'.
- Access by Soviet and other users to an electronic mail service through IAS, either from one of the sites on the Moscow network or from Western networks.
- Access to Soviet data bases at a number of the facilities of the Moscow network.

Gaining Entry Into Western Europe's EARN

In early April 1990 the board of directors of EARN approved five CEMA nations for membership: the USSR, Bulgaria, Czechoslovakia, Hungary, and Poland. Because EARN provides links to the US BITNET and other Western research networks, Soviet and East European members will gain significant benefits.

The EARN decision was not opposed by the US Government. According to an opinion delivered by the US Department of Commerce in early 1990, connection of East European facilities to EARN does not seem to require US approval, although EARN links directly to the US equivalent of EARN—BITNET—and indirectly to many other US research networks. Because of the inherent limitations of EARN and internetwork gateways, EARN was not viewed to be a threat as far as direct Eastern access to Western supercomputers, or so-called *diversion in place* (see inset). The opinion did raise the issue of the possibility of transfer of "technical data" as a form of proscribed technology transfer, but did not cite that as an impediment to current connection plans.

How the Global Networks Interconnect: Internet/BITNET/EARN Gateways

The Internet began as an interconnected set of US research networks—networks can be interconnected when a computer attached to two separate networks is used as a "gateway" to pass information between the two. Even though the Internet seems to users to be a vast pool of easily accessible computers, it is actually composed of thousands of national, regional, and local networks. Because all of the constituent networks share a common data protocol, however, it is easy to extend the same set of services to all of the computers of the Internet, and users need not know about the underlying network structures.

Gateways are more important when two networks do not provide the same services, when the protocols differ, and when they serve as security barriers. At this time the Internet and BITNET/EARN do not support the same protocols, and gateways between the two are more obvious to users. A user who wishes to send an electronic message from a computer on the Internet to a user on a computer attached only to EARN would have to express the latter's address as a combination of an EARN address plus information to route the message to an Internet/EARN gateway. Even though this is a simple process, the connections between the Internet and EARN are far less seamless than those between the various networks that make up the Internet. In addition, EARN supports fewer services than those offered by the Internet—in particular, EARN users cannot establish interactive connections to remote computers but are limited to file and message transfer. As such, the Internet/EARN gateways can pass electronic mail messages, but an EARN user cannot log in to an Internet host.

The gateways that pass message traffic between the Internet and BITNET/EARN and the BITNET-to-EARN connections could enforce some degree of security. It would be possible, for example, to attempt to restrict message traffic so that a given foreign host computer could not send mail to the US domestic networks and vice versa. According to the EARN bylaws, only full members of EARN enjoy an unqualified right to pass messages to BITNET users—associate members may be granted similar privileges only by a decision of the EARN board—but it is not known whether such discrimination is indeed in force.

For several reasons, however, gateway discrimination is unlikely to be a useful factor in any discussion of East-West networking. Gateway restrictions might be avoided, for example, through the use of an intermediary. A user enjoying full EARN membership could pass traffic back and forth between a BITNET user and another user in a country enjoying only EARN associate membership. As far as the issue of access to sensitive resources such as supercomputers, current access controls on the machines themselves are probably sufficient to deter illegal use.

According to discussions conducted via electronic mail on EARN, plans for the extension of EARN into Poland were well under way by April 1990 (see figure 5). The participants included at least two Poles who access EARN from Poland through electronic mailboxes at a university in Denmark and the Centre Europeen Recherche Nucleaire (European Center for Nuclear Research) in Switzerland.

It is planned that Warsaw University will provide the "international" node of the EARN extension (the one computer with a link out of Poland) in the form of an IBM 370–compatible BASF mainframe. Funds have been allocated by the Polish Committee for Science and Technological Development to pay for the EARN membership fee, a leased communications line to a Denmark EARN site, and other requisite hardware and software.

The various interested parties in Poland are in the process of forming an EARN users group. The previously established KASK may be utilized to extend EARN to several other cities—Wroclaw and Lodz were cited as candidates. Any number of users at other remote sites could make use of the Polish computers participating in EARN if the latter are equipped with modems to permit dial-up access.

From statements by the EARN board of directors there is no indication that East Germany has sought connection to EARN. With German unification, it will be possible to extend West Germany's EARN and even the Internet connections to East German sites. West Germany is already negotiating with East Germany to help modernize the East German telephone and network services infrastructure.

Commercial Connections

The first East-West joint venture for computer communications services was the SFMT, established in the mid-1980s. A joint Soviet–West German venture, Interlink USSR, recently announced new services starting in the latter part of 1990, to include fax (facsimile) and electronic mail. As of March 1990 data base access (presumably to the data bases accessible via IASNET) was to be added. Although Interlink USSR may be nominally competitive with SFMT, it is likely that both make use of the IAS network connections into Moscow.

SFMT was created as a value-added computer service—providing a variety of high-level user services and insulating the user from the technical aspects of communications—by using the network connections of IAS. SFMT was designed for the convenient interchange of electronic mail, fax, and other transmissions between US and Soviet users. SFMT permits the use of both Latin and Cyrillic alphabets.

In January 1989 SFMT's transatlantic connection, which had previously been made over conventional public network services, was moved to Intelsat. IAS serves as the SFMT's point of entry into the USSR. US users may access the US end of SFMT from any of several public computer networks, but the Moscow end is far more restricted.

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Figure 5
Polish EARN Extension

The actual number of Soviets now using SFMT or the other services of IAS is small, in part because of technical constraints; IAS is a small island of computing resources amid the poor Soviet communications infrastructure. There is, thus far, no commercial service to provide universal access like that afforded by the many value-added network services—Compuserve, Telenet, and so on—now available in the West.

One use of SFMT is to provide computer services to Westerners working in Moscow, permitting better communication with parent companies and contacts in the West. There is a modest market in the USSR in supplying technical services to Westerners—Alphagraphics recently opened a facility in Moscow to

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provide printing and xerographic support to hard currency customers—and SFMT's share in this market may make it a viable joint venture even if Soviet use is minimal. The costs for Soviet users are currently subsidized by Western user fees.

Outlook and Implications

Integration of CEMA Networks With the Global Network

The non-CEMA networks have achieved a "critical mass" that strongly encourages new growth. Connections with the global networks would immediately increase the utility of intra-CEMA networking. Likely scenarios for growth will still leave the CEMA networks at a substantial lag behind the West, however, with the poor technological infrastructure being the major restraint.

If CEMA computers or computer networks establish reliable ties to the Western research networks—and connection to EARN is a good beginning—Soviet and East European researchers will experience a significant leap in accessibility to global resources. Not the least important function of the research networks is the mechanism they provide for collegial interaction via electronic mail; a researcher in Bon· can share insights and data with a colleague in Boston and expect responses in a few hours rather than the weeks required via traditional mail, and at no direct cost to either individual.

The East-West connections will have a significant effect on the development of domestic CEMA networks. A[ ] who discussed Akademset' with its Soviet users concluded that "Akademset' is a toy. There is no reason to connect to it, because there is nothing to which to connect." If Akademset' were to be connected to EARN, each new host attached to Akademset' would, in theory, immediately enjoy the full range of services and resources that EARN now encompasses.

Unquestionably, the poor telecommunications infrastructure will exert a curbing influence on network growth. The effect is probably most significant in two areas: the interconnectivity of regional networks and the connection of users to local hosts. The former is clearly visible in implementations like the Latvian Academy of Sciences and Novosibirsk Akademgorodok networking, where local networking is left to—and has been achieved by—academy institutes, but connections to Moscow and elsewhere via Akademset' are dependent on the Ministry of Communications and are regarded as expensive and unreliable.

The difficulty of connecting users to local hosts is well known as the "last mile" problem—a common communications issue in less developed countries—where, even when intercity satellite links may be available, a user cannot obtain a reliable crosstown connection to reach them. If the public phone systems do not support simple and reliable connections, networking will remain restricted to the inflexible interconnection of technological institute "islands" with dedicated connections. The Moscow NCADE is reported to be accessible via modem at low speed (300 bits per second)[ ]and the ability to establish long-distance connections to Western services[ ]has been proved, but the Soviet public phone network should be regarded as barely sufficient for such data communications.[1]

Access to Western Information: Direct and Inexpensive

The Western networks promote scholarly exchange; better East-West network connections will enable increased Soviet and East European participation in international scientific forums. According to the[ ] researchers at US physics laboratories use the service to communicate with their counterparts at the Kurchatov Institute of Atomic Energy in Moscow, which he characterized as "the bombmakers talking to each other."

[1] According to various open sources, there are a few packet radio stations in the USSR, similar to the Estonian PC-based bulletin board, but relying on amateur radio communication rather than the telephone system. Although this avoids problems caused by the inadequate telephone network, it is a far less common technology and is unlikely to make a significant impact in the areas under discussion.

Secret

A great deal of information in electronic form in the West could be conveniently absorbed via networks—the Western research networks are both communications channels and information archives. Past Soviet and East European use of Western commercial data bases is likely to increase, especially as better and cheaper East-West commercial links are established.

The East-West connections, as currently proposed or being implemented, do not seem to raise any issue of *diversion in place*, whereby Eastern researchers would gain illicit access to Western supercomputers sited in the West. Although remote access to such facilities is provided to many Western users, the nature of proposed network services, the restrictions imposed by gateways, and user access controls minimize any such threats.

Increased Accessibility of Soviet and East European Research

Networking will grant Eastern researchers better access to Western resources, but increased East-West networking will also provide better remote access by Westerners to Eastern researchers and research facilities. The dissemination of Eastern research results will be enhanced, giving us better insight into the nature of research programs—including, in all likelihood, programs supporting military applications.

There may be an increasing role for East-to-West technology transfer, which research networking will accelerate. Negotiations have been under way for some time to open Soviet data bases at scientific and technical research institutes like VINITI (already on IASNET) to commercial subscription. Western research services often charge in excess of $100 an hour for access to even general research data bases—rates that may seem irresistible to Soviet data providers in desperate need of hard currency. One Western information service has initiated a joint venture with VINITI to substantially upgrade VINITI's hardware base with a new computer center—the Western firm would recoup the investment as VINITI's data was sold to Soviet and foreign subscribers.

The "Hannover Hacker"

We have already learned about one Soviet effort to carry out illicit technology transfer via the Western research networks, the case of the "Hannover Hacker." According to press reports, West Germans, acting at the direction of a Soviet handler, engaged in a form of espionage over the Internet. Breaking into user accounts on computers in the United States and Western Europe by exploiting poor network security—including easily guessed or default passwords—the Germans stole proprietary and otherwise sensitive data. Although none of the data were classified, some of it could be considered "technical data" that might have been restricted from export to the USSR by COCOM.

According to information provided in the press, the Soviets paid a considerable amount of money for the information and stolen passwords they received. The sum of the damage caused by the hackers—even bearing in mind the possible effects of the transfer of technology—does not seem to be substantial enough to warrant the expenditure. The operation's exposure, however, could be considered a fluke (the hacking was not detected by any intelligence or police agency in any of the affected countries—it was discovered and pursued by a US academic researcher), and the Soviets may have anticipated far more productive future collection from the use of stolen passwords.

Opportunities for Intelligence Services

Increased East-West exchange may provide Soviet and East European services with additional opportunities for open-source collection, as well as better methods for identification of and access to intelligence targets. The global networks could permit a far more cost-effective assessment of intelligence issues and targets, obviating the need to tax the limited number of human collectors in the countries of interest. The idea of conducting intelligence collection via electronic mail

might seem ludicrous, but computer networking represents a fundamentally new communications medium with global reach and a quick response time.

The case of the "Hannover Hacker" is proof that Soviet intelligence has attempted to exploit Western networks on at least one occasion (see inset).

The utility of unclassified information to support and supplement clandestine intelligence collection should not be overlooked, and unclassified data bases are proliferating worldwide.